A

Synopsis of the thesis entitled:

"Investigations on Soil Nutrients to Assess the Soil Quality and its Effects on Crops: Studies of Selected Villages from Ardhapur Tehsil, District Nanded (MS)"

To be submitted to

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

By

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1.0 Introduction:

1.1 Soil:

Soil is one of the important and valuable resources of the nature. It is composed of broken rock particle that have been transformed by chemical and mechanical processes. All living things are directly and indirectly dependent on soil for day to day needs and 95 % human food is derived from the earth. Soil has complex function which is beneficial to human and other living organism (Sumithra et al., 2013).

Soil is one of the most significant ecological factors, on which plants depend for their nutrients. (Shaikh et al., 2012) It is an uppermost layer of earth's crust and is a mixture of organic matter, minerals and organisms that together support life. Soil plays a vital role in maintaining the balance of earth's ecosystem (Nesme et al., 2014).

The superiority and strength of soil determine agricultural sustainability and environmental quality which is determines plant, animal and human health. The status of available micronutrients in soils and their relationship with various physicochemical properties have been studied by several Investigators (Asema et al., 2015).

Soil analysis is the way to determine the available nutrient status in soil and the only way we can develop specific fertilizer recommendations (Raman and Sathiyanarayanan, 2009). The crop growth and yield largely depend upon soil resources and their characteristic as they provide water and nutrients for the growth and yield of crops. The existing macro and micronutrients in the soil profiles aid in determining the soil potential, which are essential for better scientific utilization of crop growth (Rajeshwar et al., 2016).

The study of soil physicochemical parameters is important to agricultural researcher for plants growth, soil management and plant productivity. The properties such as moisture content, specific gravity, nitrogen as a fertilizer required for the growth of plant (Chaudhari, 2013).

The soil condition is important because it is a universal medium for plant growth, which supplies essential nutrients to the plants (Ganorkar et al., 2013).

It is presumed that certain native trees and differences in vegetation type are likely to impart soil properties. This is for the fact that soil supports particular type of flora and fauna (Wild, 1993) Accumulation of heavy metals in agricultural soil is a subject of increasing concern due to food safety issues and potential health risks as well as detrimental effects on soil ecosystem. (Shaikh et al., 2012)

Plants grown on polluted land with municipal, domestic or industrial wastes can absorb heavy metals in the form of mobile ions present in soil solution, through their roots or through foliar absorption. It is well known that soil organic matter is a reservoir for plant nutrients, enhances water holding capacity, protects soil structure against compaction, erosion and thus determines soil productivity. Maintenance of organic matter is critical for preventing land degradation Salinity of soil cause osmotic stress, which can reduce crop yields (Trivedi et al.,1998).

In Marathwada region, now a day, large number of chemical fertilizers are used instead of manures due to this the crop yield increases promptly but the quality of the soil and the microbial diversity is decreasing very rapidly. The information on the physicochemical parameters of soil on the study area is known. Therefore, present study was considered to evaluate the soil Nutrients to assess the soil quality and its effect on crop of selected villages in Ardhapur tehsil, district Nanded district, Maharashtra.

1.2 Factors affecting soil quality

There are many factors which affect soil quality; it includes faulty agricultural practices, chemicals, deforestation, soil degradation and erosion, biodiversity loss and desertification. A major cause of reduced soil quality is soil erosion, the removal of the topsoil. Although soil erosion is a natural geologic process, it is often accelerated by cultivation and resource development to meet human needs. However, erosion losses from non-agricultural such as logging, construction, off-road vehicles, floods, droughts, and fires. Erosion degrades soil

condition by lowering organic-matter content, decreasing rooting depth, and decreasing available water capacity.

1.3 Nutrients:

A nutrient is a substance used by an organism to survive, grow, and reproduce. Plants require more diverse minerals absorbed through roots, plus carbon dioxide and oxygen absorbed through leaves. Plant nutrition the study of the chemical elements and compounds necessary for plant growth, plant metabolism and their external supply. In its absence the plant is unable to complete a normal life cycle, or that the element is part of some essential plant constituent or metabolite. A classification used primarily to describe nutrient needs of animals divides nutrients into macronutrients and micronutrients.

1.3.1 Micro nutrients:

Micro nutrients are the elements required in small amounts. There are some essential plant nutrients defined as micronutrients i.e. boron, zinc, manganese, iron, copper, molybdenum, chlorine etc. Deficiency of any of these nutrients affects growth and development of plant.

1.3.2 Macro nutrients:

Macro nutrients are elements which are require in relatively large amounts. These nutrients include carbon, nitrogen, phosphorus, sulfur, calcium, potassium etc. Carbon, hydrogen and oxygen obtain from air and water while the other are received from soil.

1.4 Significance of Macro and Micronutrients:

Macronutrients and micronutrients in plants fall under essential nutrients that support plants for all biochemical needs and without which a plant can't complete its life cycle. Other elements can't replace a specific function for a plant. It helps to generate new plant cells which organize into plant tissue.

1.5. Problem statement:

It is observed that the soil quality in the selected area is getting deteriorated very rapidly. The main reasons behind this include excessive use of chemical fertilizers for growing huge amount of commercial crops including banana, turmeric and sugarcane, whereas some areas are still working on traditional agriculture. This is being also highlighted by the local newspapers.

This is an attempt to understand the reasons behind degrading soil quality and to find out the probable solution to address this issue and to help the local farmers.

1.6. Proposed outcomes:

The major focus will be on estimation the soil quality status of selected study area with the help of analysis of macro and micro nutrients in soil. It will be useful to study agricultural plant growth and manage soil quality. The study is also important to recommend the necessary substitute for chemical fertilizers hampering the soil quality. The work will be highlighting the pollution sources and their status in the selected villages. This information will help farmers to solve the problems related to soil nutrients. Also, it gives information about nature of soil.

2.0 Study Area

Ardhapur is a Town and Taluka (formed on December 30, 1999) in Nanded district of Maharashtra state. Nanded district is located between 18˚.15ˈand 19˚.55ˈnorth latitude and 77˚.7ˈ to 78˚.15ˈ east longitudes.

It is located at a distance of 19.3 km from Nanded on Nanded-Nagpur State Highway. It has 56 villages, 39 Gram Panchayats and 1 Nagar Panchayat. It is very well known for Banana and sugarcane cultivation. Other grown crops include cotton, soyabean and turmeric etc. The population of Ardhapur tehsil is 1,09, 332 according to census of 2011 and they are mostly dependent upon agriculture for their survival.

For this study we have selected villages come under Ardhapur tehsil. Selection of villages based on its cropping practice in Ardhapur region as some farmers take cash crop and some takes traditional crops, it's totally depends upon land type as irrigated and non-irrigated.

The following villages are selected for present study i.e.,Lahan, Ambegaon,Chabra, Chenapur, Loni, Belser, Rodgi, Pangari, Sheni, Pardi, Sangavi, Mendla (bk), Mendla(kh), Konda, Nandusa, Kamtha, Shelgaon, Pimpalgaon, Yelegaon, Bamni, Sawargaon, Umari, Malegaon, Barasgaon, Dabhad, Degaon, Delub, Dhamdari, Jambharun and Ardhapur.

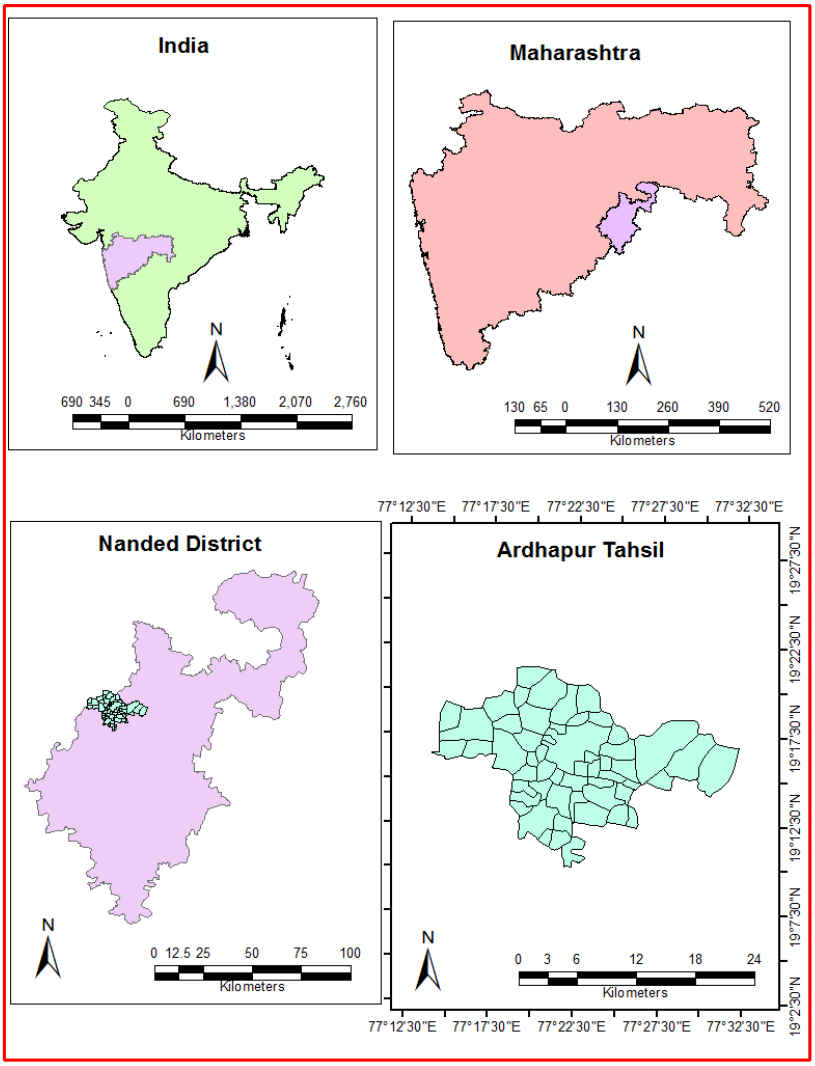

Fig 1.1 Location map of Ardhapur Tehsil

3.0 Review of literature

Asema et.al., (2015) analysed soil sample for its physiochemical parameters from Aurangabad city. This study reveals that the physicochemical parameters of soil samples showed dissimilar values at different places. This can be due to the irregular distribution of parameters present in soil.

Sumithra et. al. (2013). analysed physicochemical characteristics of soil around industrial and agricultural area of Yerraguntla, Kadapa district, AP. This study reveals that the soil is rich in calcium and magnesium. The pH of most of the soil samples was found to be alkaline. The level of organic carbon, EC, phosphate, sodium and sulphate were high near stone crushing area, whereas potassium level was found medium in most of the studied areas.

Raman et. al., (2009) worked on the physicochemical aspects of soil and influence of cation exchange capacity in and around Chennai. Soil samples were in the permissible limit except in some places. In Velachery, Nandambakkam, Ambattur and Guindy the soil quality was polluted only due to the industrialization.

Ganorkar et. al., (2016) studied assessment of soil nutrients and physico chemical parameters in region of hiwarkhed village of Amravati district (MS). A marked variation in physicochemical parameters of various soil samples in different farmer's field was observed.

Ghode et. al., (2020) worked on vertical distribution of available macro and micronutrient in cotton growing soil of Nanded district, Maharashtra. It was carried out to assess the horizon wise nutrient stat from seven representative soil samples. The amount of nutrients in soil profiles was lowered with the depth of soils.

Indrajit et. al., (2015) made physico-chemical assessment of agriculture soils at Basmath Tehsil of Hingoli district in Maharashtra. This study determined that the selected study area has black cotton alluvial soil, which is rich in calcium and magnesium. The pH of soil was slightly neutral and OC, calcium carbonate was low, showed favourable conditions for maximal yield of crop.

4.0 Objectives

- To determine the soil quality of selected agricultural area of Ardhapur tehsil in Nanded district.
- To study some important physico-chemical parameters (pH, electric conductivity, water holding capacity, soil moisture, Organic carbon, Alkalinity).
- To estimate the macro-nutrients from selected area (Nitrogen, Phosphorus, Potassium, Calcium, Magnesium).
- To estimate the micro-nutrients from selected area (Iron, Copper, Zinc, Manganese).
- Soil fertility evaluation with the help of macro and micro nutrients as well as physico-chemical parameter of soil by laboratory analysis.
- Evaluation of effects of soil on crop quality.

5.0 Methodology

Physico-chemical parameters of soil

- **pH**

pH is the measure of hydrogen ion activity and depends largely on the relative amount of the absorbed hydrogen and metallic ions. It is a good measure of the intensity of acidity and alkalinity of identification of the chemical nature of soil. The pH of soil suspension highly depends on the soil water rations. Determination of pH at moisture saturation level and 1:5 soil suspensions is most common. It is important because it influences the presence of essential nutrient. The pH of soil determines with the help of pH meter.

- **Electric Conductivity (EC)**

Electric conductivity denotes the capacity of a substances or solution to conduct the electric current as well as of current carrying and capacity gives a clear idea of the soluble salt present in the soil. It is an important indicator of soil health, Excess salt hinder plant growth by

affecting the soil water balance. EC of soil determines with the help of Electric conductivity meter.

- **Water Holding Capacity (WHC)**

Water holding capacity of soil usually refers to amount of maximum water which can be held in the soaked soil. It is generally measured as the amount of water taken up by unit weight of dry soil when immersed in water under standardized conditions determines as the amount of maximum water held in selected soil samples. Maintaining soil water holding capacity can mean increased profits of farms. Soil water holding capacity is a term that all farms should define soil water holding capacity is the amount of water that a given soil can hold for crop use. It determine as the amount of maximum water held in saturated solids.

- **Soil Moisture**

Soil moisture is a key variable in controlling the exchange of water and heat energy between the land surface and atmosphere through evaporation and plant transpiration. As a result, soil moisture plays an important role in the development of weather patterns and the production of precipitation.

- **Organic Carbon**

Soil organic carbon is the main component of soil organic matter (SOM). Soil organic carbon is important contribution in food production. Higher SOC promotes soil structure. This improves soil aeration (oxygen in the soil) and water drainage with retention. It also reduces the risk of erosion and nutrient leaching. Organic carbon content of selected soil sample determines by titrimetric method.

- **Alkalinity**

Soil alkalinity or salinity is a condition that results from the accumulation of soluble salt in soil. Alkaline soil with clay and high pH shows a poor soil structure and low infiltration capacity. The high pH soil cause reduces essential plant nutrients. Soil alkalinity is due to the

presence of soil minerals producing sodium carbonate upon weathering. It is determined by the titrating the soil suspension with a strong acid using methyl orange as an indicator.

Macro-Nutrients: Nitrogen (N)

Plant requires more nitrogen than any other nutrient but only a small portion of the nitrogen is soil is available to plants. The soil fertility nitrogen is very important for plant growth for its structural metabolism and the creation of chlorophyll deficiency of nitrogen plant cannot grow taller or can't produce enough food. The selected soil sample available nitrogen determines by alkaline permanganate method.

Phosphorous (P)

Phosphorus in soil generally determined as available phosphorus which can be extracted from soil. Its primary role in plant is to store and transfer energy produced by photosynthesis for use in growth and reproductive process. From the selected soil samples available phosphorus can be is determined by extracting it with sulphuric acid by stannous chloride method by spectrophotometer at wavelength 690 nm.

Potassium (K)

Potassium triggers activation of enzymes and is essential for production of ATP and uptake of water through plant roots. Its loss through the stomata is affected by potassium knows to improve drought resistance. Proteins and starch synthesis in plant require potassium as well. Potassium is determined in neutral normal ammonia acetate extract of soil using flame photometer.

Calcium (Ca)

Calcium contributes to soil fertility by helping maintain a flocculate clay and therefor with good aeration soil structure and water holding capacity are improved. Exchangeable calcium is determined in ammonia acetate leachate by titration technique.

Magnesium (Mg)

Magnesium has an important role in maintaining soil structure. Together with other polyvalent cation particular calcium, magnesium also forms bridges between negatively charged clay minerals. This supports a stable, friable soil structure with prevents capping. Exchangeable magnesium is determined in ammonia acetate leachate by titration.

Micronutrients: Iron (Fe)

Iron is an essential micronutrient for almost all living organisms. It plays an important role in photosynthesis, an imbalance between the solubility of iron in soil and demand for iron by the plant are the primary cause of iron chlorosis which gives plant oxygen as well as its health green colour, it is also necessary for some enzymes functions in may plants. Iron estimated by acid digestion of soil using standard thiocyanate method on UV-Spectrophotometer at wavelength 510 nm the result will be expressed in mg/L or mg/kg.

Copper (Cu)

Copper is required for many enzymatic activities in plants & for chlorophyll with seed production. Deficiency of copper can lead to increased susceptibility to diseases like ergot which cause yield loss in small grains. Copper estimated by acid digestion of soil using standard Neocuproine Method on UV-Spectrophotometer at wavelength 457 nm the result will be expressed in mg/L or mg/kg.

Manganese (Mn)

Manganese is considered an essential micronutrient for the metabolic process in plants. Nevertheless, both deficiency and excess alter these processes acid soils make excessive amount of (Mn) toxic for the plants Mn toxicity is a worldwide problem in areas with acid soils. It plays important role in plant growth like various biological systems including photosynthesis, respiration and nitrogen assimilation. It is also involved in pollen germination growth of pollen tube, elongation of root cells and resistance to root pathogens. Manganese is estimated by

standard persulphate method on UV-Spectrophotometer at wavelength 545 nm and result will be expressed in mg/L or mg/kg.

Zinc (Zn)

It is essential micronutrient gives an important role in formation of chlorophyll and some carbonated and conversion of starch to sugar. Zinc is essential in the formation of auxins which help growth and regulation of stem elongation. Deficiency of zinc in soil plant may discolour the tissue between the veins to turn yellow while the veins remain green. It is estimated by standard Dithizone Method on UV-Spectrophotometer at wavelength of 535 nm and result will be expressed in mg/L or mg/kg.

6.0 Significance of present work

Soil health and soil quality are defined as the capacity of soil to function as a vital living system within land use boundaries. This sustains biological productivity of soil also maintains the quality of surrounding environment and human health. Thus, the two terms are used interchangeably while it is important to distinguish that, soil quality is related to soil function, whereas soil health presents the soil as a finite non-renewable and dynamic living resource.

Adverse effects on soil health and soil quality arise from nutrient imbalance in soil, excessive fertilization, soil pollution and soil loss processes that are increasingly becoming common in developing countries. This study will be focusing on the development of soil health approaches as well as the content of soil health and soil quality information and its application to reduce negative impacts of agricultural productivity and long-term sustainability.

7.0 Work plan

Time (month)	Work
0-2	Review of literature, Pre-sampling and laboratory preparation.
3-27	Sampling, analysis, data collection and interpretation of data, publication of result.
28-30	Thesis writing and submission

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